

INDEX

- Abbot, C. G., 325
 Absolute magnitude, 13; of sun, 14, 149.
See Luminosity
 Absorption, of radiation, 3, 20, 21, 47, 217;
 of light in space, 384
 Absorption coefficient, for terrestrial X-rays,
 22, 236; relation to emission coefficient,
 50, 54, 106; astronomical determination of,
 118, 146; law of variation, 121, 202, 219,
 229, 248; in photosphere, 355; mono-
 chromatic, 368
 Absorption edges, 70
 Absorption lines, 238; formation of, 337;
 broadening of, 353; fixed lines, 377
 Abundance of the elements, 369
 Accretion of mass by stars, 391
 Adams, W. S., 2, 160, 171, 172, 307
 Adiabatic changes, 35; equilibrium, 97; pul-
 sations, 186
 Adiabatic principle, 72, 355
 Aetherial heat, 18
 Age, of sun, 289; of earth, 290
 Aitken, R. G., 150, 155
 Albedo of stars, 211
 Algol, 209
 Amplitude of pulsations, 185, 195
 Anderson, J. A., 12, 300
 Annihilation of protons and electrons, 293
 Aston, F. W., 293, 295
 Astronomical constants, values of, 395
 Atom, structure of, 10
 Atomic absorption coefficient, 54, 236
 Atomic numbers of elements, 10, 252
- Balancing, principle of detailed, 45
 Band spectra, 350
 Betelgeuse, 6
 Bialobjesky, I., 397
 Binary hypothesis of Cepheids, 184
 Binary stars, 11, 152, 161; mass ratios of,
 160; change of mass, 311, 312
 Birge, R. T., 350
 Bjerknæs, V., 286
 Black body, 39; sun's deviation from, 325
 Blackness of absorption lines, 340, 342, 347,
 350
 Bohr atom, 60, 72
 Bolometric magnitude, 13; reduction to
 visual magnitude, 138
 Boltzmann's constant, 51
 Boltzmann's formula, 49; inapplicable to
 free electrons, 263
 Boundary conditions, 95, 116, 127, 211
 Boundary temperature of stars, 323, 332
 Bright line spectra, 343
 Broadening of spectral lines, 353; in Ceph-
 eids, 206
 Buisson, H., 330
- Calcium, in chromosphere, 362; in inter-
 stellar space, 378; ionisation of, 345, 349,
 382
 Cameron, H., 318
 Campbell, W. W., 11, 147
 Canonical variables, 58
 Capella, 11, 14, 85, 145
 Capture of electrons, 23, 218, 221, 230, 245
 TV Cassiopeiae, 214
 Cell of unit weight, 68
 Central temperature of stars, formulae for,
 85, 136; minimum value, 91; numerical
 values, 136, 151, 182; constancy on main
 series, 177, 299
 δ Cephei, 146, 199, 290
 Cepheid variables, 157, 180, 290
 α Ceti, 206, 208; companion of, 173
 Chapman, S., 277, 279, 280
 Chemical constitution of stars, effect of, 2,
 10, 243; assumptions as to, 250, 370
 Chromosphere, Milne's theory of, 362
 Circulating currents in rotating stars, 285;
 tendency to die out, 99
 Classical theory, of emission, 223; of electron
 scattering, 77
 Classification of spectra, 2
 Cloud, interstellar, 378
 Clusters, masses of stars in, 162; variables in,
 181; giant and dwarf stars in, 310
 Coeval stars, difficulty arising from, 310, 392
 Collisions, inelastic and superelastic, 339, 373
 Companion of Sirius, 171
 Composition. *See* Chemical constitution
 Compressibility of a gas, 165
 Compton effect, 76, 316
 Condensations in interstellar medium, 381
 Conduction of heat, 97, 281
 Constants, list of natural, 395
 Contraction hypothesis, 5, 289
 Contrast. *See* Blackness
 Contrast, centre-limb, 328, 331; in chromo-
 sphere, 365
 Convection currents, 98, 285
 Convective equilibrium, 9, 97
 Conversion of subatomic energy, 315
 Correspondence principle, 53, 64, 230, 241, 263
 Currents, circulating, 98, 285
 Cyanogen bands, 350
- Dark nebulae, 387
 Darkening at the limb, 212; law of, 324
 Debye and Hückel's theory, 264, 280
 Decay of pulsations, time of, 199
 Delaunay's canonical variables, 58
 Dense stars, 130; gas laws in, 165
 Density, of photosphere, 336, 360; of chromo-
 sphere, 368; of interstellar matter, 372
 382; of nebulae, 382

- Density of stars, 5, 8; ratio of central to mean density, 84; mean densities of stars, 136; high density possible, 170
- Destruction of matter, 293
- Detailed balancing, principle of, 45
- Deviations from perfect gas, 260; in ionised gas, 263; in stars, 131, 165
- Diameter. *See* Radius
- Dielectric constant, 237
- Diffuse matter in space, 371
- Diffuse nebulae, 387
- Diffusion, coefficient of, 277; thermal, 276; of electrons, 273
- Dilution, factor of, 382
- Disorganisation of energy, 30
- Displacement law (Wien's), 39
- Dissipation of energy in Cepheids, 198
- Distribution, of elements in a star, 275, 298; of subatomic sources, 122
- Dootson, F. W., 277
- Double stars. *See* Binary stars
- Doublets, 74
- Douglas, A. V., 307
- Duration of stages of evolution, 309
- Dwarf stars, 7, 130; white dwarfs, 170
- Dynamical parallaxes, 158, 161
- Earth, age of, 290
- Eclipsing variables, 156, 208
- Effective temperature, of radiation, 37; of a star, 2, 120, 135, 140, 323; of radiation in space, 371
- Eggert, J., 346, 399
- Einstein's equation, 46, 56
- Einstein's theory of gravitation, 6, 172; identity of mass and energy, 294
- Electric charge in a star, 272
- Electrons, 10; orbits of, 58; K and L groups, 69; capture of, 24, 218, 221, 230, 245; scattering by, 74, 77, 316, 385; free, 64, 263; runaway, 302; destruction of, 293
- Electrostatic energy and pressure, 264; correction to ionisation, 257
- Elements, atomic numbers and energy levels of, 252; stellar abundance of, 369
- Emden, R., 5, 81
- Emission coefficient, 24, 47, 218, 329; relation to absorption coefficient, 50, 54, 105; theories of, 223, 229, 245
- Emission lines, 343
- Enclosure, 35, 39, 100
- Energy, of a polytrope, 86; of a star, 141; of a white dwarf, 172; of the sun, 289, 292; of ionisation, 269
- Energy, subatomic, 292
- Energy and mass, 27, 294
- Energy levels in atoms, 252, 257
- Energy-density of equilibrium radiation, 38; relation to pressure, 29
- Enhanced lines, 345
- Enskog, D., 277
- Entropy, 30
- Equilibrium of a star, 9, 79; stability of, 142
- Equilibrium radiation, 36
- 66 Eridani, 380
- Escape of atoms, 368, 392
- Evenly diluted radiation, 376, 382
- Evershed, J., 362
- Evolution of stars, 7, 174, 296, 309
- Exchanges, principle of, 35, 45
- Excited atoms, 45, 66, 238, 259, 346; life of, 364
- Excluded volumes, 259
- Exhaustion of subatomic sources, 297, 299
- Fabry, C., 330, 371
- Fixed calcium lines, 377
- Flow of heat, 100, 321; variable, 197
- Fowler, A., 73, 345
- Fowler, R. H., 194, 220, 256, 266, 347, 379
- Free electrons, 64, 263
- Free path, 222, 277, 280, 368, 373
- Frequency. *See* Wave-length
- Gas, deviations from perfect, 131, 165; theory of, 260, 263
- Gas-constant, 8
- Gas-sphere, 79; polytropic, 80; isothermal, 89; tables, 82, 90
- Gerasimović, B., 286
- Giant and Dwarf theory, 2, 119, 163
- Giant stars, 5, 176; masses of, 307; lower effective temperature, 361
- Gravitation opposed by radiation pressure, 17
- Gravity on Capella, 15; on the sun, 395
- Guggenheim, E. A., 256, 266
- Guillotine, 231, 256; factors, 233
- Güssow, M., 181
- Gyllenberg, W., 207
- Hamiltonian equations, 59, 67
- Hartree, D. R., 257
- Heat, aetherial and material, 19; irreversible flow of, 32; radiometer measurement of, 138, 206; sun's store of, 289
- Helium, formation of, 292, 296, 301, 314, 315, 317
- Helmholtz, H. L. F., 289
- Hertzsprung, E., 7, 139, 152, 158, 161, 164, 180, 290, 310
- Hubble's variable nebula, 387
- Hyades, 158
- Hydrogen, exceptional behaviour of, 10, 244, 276, 315; quantisation of, 58; transmutation of, 293, 296, 301, 314
- Hypothetical parallaxes, 158, 161
- Initial temperature of electron gas, 376
- Inner quantum number, 74
- Inside of a star, 19
- Insight, 102
- Interferometer, 6, 12, 171
- Interstellar space, 371; calcium cloud in, 378
- Invariance of weights, 68
- Inverse square forces, 168

- Ionisation, 10; equation determining, 65, 66; applied to stars, 251, 254; energy of, 142, 269; in Cepheid variables, 204; in reversing layer, 345; in interstellar medium, 382
 Ionisation potentials, 252, 257, 383
 Ions, size of, 166, 359; diffusion of, 273
 Iron, ionisation potentials of, 257
 Irreversible processes, 32
 Isothermal gas-sphere, 89, 92, 382

 Jeans, J. H., 3, 10, 203, 281, 287, 303, 312, 322
 Joy, A. H., 160, 307

 K electrons, 23, 69, 217, 252
 Kelvin, 5, 289, 294
 Kohlhörster, W., 317
 Kohlschütter, A., 2, 342
 Kramers, H. A., 223, 225, 229
 Krueger 60, 150
 Kulenkampff, H., 234, 238, 249

 L electrons, 23, 69, 217, 252
 Lane, H., 4, 7, 163
 Laplace, 6
 Larmor, J., 294
 Leavitt, H. S., 181
 Light, absorption of, 383
 Light curve of variables, 147, 180, 205, 208, 210
 Light ratio for I magnitude, 14
 Lindblad, B., 322, 325
 Lindemann, F. A., 10
 Line absorption and emission, 111, 238; formation of absorption lines, 337, 381; intensity of, 342, 350; width of, 353; emission lines, 343
 Lockyer, J. N., 6, 345
 Long period variables, 206
 Luminosity of stars, relation to mass, 151; relation to spectral type, 175; relation to period in Cepheids, 181; relation to heat radiation, 138
 Luminous efficiency, 13, 138, 213

 Magnetic field of star, 389
 Magnitude, 13, 14. *See* Absolute magnitude, Bolometric magnitude, Luminosity, Mass-luminosity relation
 Main series, 151, 176, 177, 210, 215, 299
 Mass, relation to energy, 27, 292, 294; distribution in a polytrope, 86; of chromosphere, 368; of nebulae, 388
 Masses of stars, determined by radiation pressure, 16, 118, 308; method of determining, 12; large masses, 148; initial masses, 307; change of, 176, 306, 312, 391; principal formulae involving, 135
 Mass-absorption coefficient, 22, 100
 Mass-luminosity relation, theory of, 116, 118, 135; table of, 137; curve, 153; agreement with observation, 158; applied to Algol, 210
 Mass-ratios in binary stars, 160, 311
 Mathematicians, 102
 Maxwell's equations, 57
 Maxwell's law, proof of, 51; for electrons with negative energy, 64
 McDiarmid, R. J., 214
 McLaughlin, D. B., 214
 Merrill, P. W., 12, 207
 Metastable orbit, 74
 Michelson, A. A., 12
 Millikan, R. A., 318
 Milne, E. A., 287, 322, 325, 330, 347, 349, 355, 361, 362
 Minimal problems (central pressure and temperature), 90
 Molecular weight, 10; probable values of, 253, 258, 259; variation of, 128; determined by observation, 159; effect of change, 255
 Molecules, absorption by, 386; band spectra of, 350; quantisation of, 352
 Multiplets, 74

 Nebulae, 387; penetrating radiation from, 319
 Nebulium, 389
 Negative absorption, 50
 Nernst, W., 3
 Newall, H. F., 10, 11
 Nicholson, S. B., 206
 Novae, 389
 Nuclear capture, 245
 Nucleus of atom, 10

 Opacity, 3, 21; distinguished from absorption, 109; inversely proportional to luminosity, 118; astronomical measurement of, 146; law of variation, 121, 219, 229, 237, 248; variation with temperature, 202, 221, 303; of dark nebulae, 388
 Optical depth, 321
 Optical spectra, 72
 Orbits of binary stars, 11; photometric orbits, 148, 209
 Orbits of electrons, 58, 71; of large quantum number, 61, 241; hyperbolic, 224, 229, 245
 Oscillation. *See* Pulsation
 Over-stability, 201, 299

 Pannekoek, A., 273, 388
 Parallax of Capella, 13; dynamical parallaxes, 158, 161
 Parsec, 395
 Pauli, W., 70, 76
 Payne, C. H., 141, 369, 401
 Pease, F. G., 208
 85 Pegasi, 160
 Penetrating radiation, 317
 Perfect gas, 5, 8, 84, 116; deviations from, 131, 167, 260, 263; of high density, 165
 Period of pulsation, 192
 Period-luminosity relation in Cepheids, 181
 Perrin, J., 296

- Persico, E., 280
 Perturbation of electron orbits, 71
 Pettit, E., 206
 Photometric orbits, 148, 209
 Photosphere, 334, 360
 Planck's constant, 46, 395
 Planck's law, 21, 49, 53, 55
 Planetary nebulae, 389
 Plaskett, H. H., 330, 342
 Plaskett, J. S., 148, 156, 214, 378
 Plummer, H. C., 185
 Point-source of energy, solution for, 124
 Polytropic gas-sphere, 80; tables, 82; incomplete, 94; applicable to stars, 117, 128
 Potential, gravitational, 79; at centre of star, 83, 85
 Potential energy of polytrope, 86; of a star, 141
 Poynting vector, 57
 Pressure, 79; at centre of a star, 85, 91; in reversing layer, 349; in photosphere, 360; electrostatic correction to, 266, 269; broadening of lines by, 353
 Pressure of radiation, 15; theory of, 27; numerical value, 38; ratio to whole pressure, formulae, 117, 129; tables, 117, 137; determines stellar masses, 16, 118, 308; stress components of, 105, 335; in outer layers, 357, 360; in chromosphere, 362; escape of atoms by, 368
 Principal lines, 74, 346, 349, 363
 Procyon, 152; companion, 155
 Protons, destruction of, 293
 Pseudo-Cepheids, 181
 Pulsation, of Cepheids, 180; criticisms, 185; adiabatic theory of, 186; period of, 192; limit to amplitude, 194; maintenance of, 200; of long period variables, 206
 V Puppis, 147
- Quanta, 41, 46; general conception of, 57
 Quantisation, of hydrogen-like ion, 58; of molecules, 352; lack of sharpness, 60, 354
 Quantum numbers, 59, 70, 72
 Quartic equation, fundamental, 117, 129
- Radiation, 27; equilibrium of, 35; temperature of, 37; Stefan's law, 38; Wien's law, 39; Planck's law, 55; flow of, 101, 322; from accelerated electron, 77, 223; penetrating, 317
 Radiation of stars (total), 114; relation to opacity, 118; relation to mass and radius, 134; relation to luminosity, 138. *See also* Luminosity, Absolute magnitude, Mass-luminosity relation
 Radiation pressure. *See* Pressure of radiation
 Radiative equilibrium, 9, 97; equation of, 101, 107, 322
 Radiative viscosity, 281
- Radio-activity, 294, 315, 344
 Radiometer, 138
 Radius, of Cepheids, 182; of long period variable, 208; of sun, 395
 Radius of star, 2; interferometer measures, 6; method of calculating, 13; method for Algol, 210
 Rayleigh scattering, 384, 385
 Reflection effect in eclipsing variables, 210, 213
 Refractive index, 38, 237
 Relativity, 6, 173
 Reversible processes, 32
 Reversing layer, 342; pressure in, 349, 359
 Rigour of proofs, 102
 Ring nebula, 389
 Ritter, A., 5
 Rosseland, S., 109, 238, 243, 264, 401
 Rosseland's correction, 112, 247, 356, 398
 Rotating stars, brightness of, 287; currents in, 285; von Zeipel's theorem, 282
 Rotation, of Algol, 210; of planetary nebulae, 389
 Runaway electrons, 302, 320
 Russell, H. N., 7, 148, 160, 163, 177, 295, 303, 354
 Rutherford, E., 220
- Saha, M. N., 345, 347
 Sampson, R. A., 9
 Scattering by electrons, 74, 243, 384; coefficient of, 76
 Schuster, A., 400
 Schwarzschild, K., 9, 322, 342
 Seares, F. H., 174
 Selection principle, 71, 73, 351
 Series in spectra, 74
 Shajn, G., 160, 311
 Shapley, H., 8, 146, 181, 310, 342, 384
 Shielding of nuclear field by electrons, 67, 71, 264
 Shinjo, S., 203
 Silicon, spectra of, 345
 Sirius, companion of, 171
 Size of atoms and ions, 165, 262, 359
 Smart, W. M., 312
 Sodium, fixed lines of, 378, 383
 Sorting demon, 37
 Source of stellar energy, 289; relative distribution of, 122, 295; point-source, 124
 Space, interstellar, 371; temperature in, 371, 377; density in, 372, 382; ionisation in, 383; absorption of light in, 383; penetrating radiation from, 318
 Specific heats, ratio of, 9, 35; for radiation, 10, 29; for stellar material, 270; in Cepheids, 157, 190, 203; limit of stability, 142
 Spectra, X-ray, 70, 230, 234; optical, 72; molecular, 350. *See also* Absorption. Emission, Spectral type
 Spectral energy curve, 324

INDEX

407

- Spectral type, 2; Saha's theory of, 345; temperature scale, 141; magnitude statistics, 175; progression in Cepheids, 181, 208; range, 186; comparison of giants and dwarfs, 361
- Stability of a star, 142, 303
- Stark effect, 353, 355
- Stationary calcium lines, 377
- Stebbins, J., 209
- Stefan's law, 38
- Stewart, J. Q., 354
- Stimulated emission, 50, 303, 365
- Strömberg, G., 207
- Subatomic energy, 292
- Subordinate lines, 343, 346
- Sun, 149; astronomical constants for, 395; darkening at the limb, 324, 328; spectral energy curve, 328; photosphere, 336, 360; height of chromosphere, 362, 367
- Superelastic collisions, 339, 373
- Superperfect gas, 267
- Surface-brightness and effective temperature (table), 139
- Switches of orbits, 229, 375
- Target for electron capture, 221, 245
- Temperature, inside a star, 14, 84, 120, 136; mean temperature, 88, 94; in outer layers, 323; second approximation, 332; in interstellar space, 371, 377. *See also* Central temperature, Effective temperature
- Temperature-gradient in Capella, 15
- Tensors, 57, 69
- Thermal diffusion, 276
- Thermodynamical equilibrium, 44, 47; application to outside of a star, 323, 338
- Thermometric temperature, 32
- Thomson, J. J., 294
- Thunderstorms, stellar, 344
- Time, direction of progress, 44
- Time-scale, 290, 293, 309
- Transmutation of hydrogen, 292, 296, 314
- Valency electrons, 72, 379
- Valve of heat engine, 200, 202
- Van der Waals' equation, 131, 167, 259, 262
- Variable stars, Cepheid, 157, 180, 290; eclipsing, 156, 208; long period, 206
- Velocity curves of Cepheids, 180, 205
- Virial, 260
- Viscosity, 280
- Vogt, H., 285, 311
- Volts, conversion to ergs and Ångströms, 396
- Wave-length of maximum energy, 140, 325; of energy levels, 252; of subatomic emission, 316; changed by scattering, 76; conversion to volts, 396
- Weights of atomic states, 49, 61, 67, 230; for calculating opacity, 112
- White dwarfs, 170, 306
- Width of absorption lines, 353, 367
- Wien's law, 39, 48
- Wilson, C. T. R., 301, 320
- Woltjer, J., 203, 238, 240
- X-rays, 21; spectra, 70, 230, 234; absorption coefficients, 22, 217, 236
- von Zeipel, H., 162, 282, 287
- Zonal harmonics, 105